

研 究 論 文 抄 録

研究論文抄録

物質生命理工学科

M. Yamaguchi, R. Saito, K. Utsumi, A. Ochiai, N. Kawashima, Y. Tokuoka, and A. Katoh : “The Nicotinic Acid-p-Aminophenylalanine-Hydroxybenzoic Acid Triads Induces Apoptosis in Human Leukemia U937 Cells”, *Heterocycles*, Vol.71, No.7, 1503-1508, 2007.7

邦文題目：ニコチン酸-p-アミノフェニルアラニン-ヒドロキシ安息香酸三つ組はヒト組織球性腫瘍細胞 U937 にアポトーシスを誘導する

The nicotinic acid-p-aminophenylalanine-hydroxybenzoic acid triads were newly synthesized from p-aminophenylalanine methyl ester via 4 steps, and they induced apoptosis in human leukemia U937 cells. The number of hydroxyl group on benzoic acid apparently affected upon the apoptosis-inducing activity.

M. Yamaguchi, R. Saito, Y. Adachi, Y. Yoshikawa, H. Sakurai, and A. Katoh : “Synthesis of Oxo-vanadium(IV) and Zinc(II) Complexes of 3-Hydroxy-4-(p-substituted)phenylthiazole-2(3H)-thiones with a S₂O₂ Coordination Mode and Their Insulin-Mimetic Activities”, *Heterocycles*, Vol.73, 603-615, 2007.12.

邦文題目：S₂O₂配位様式をもつ3-ヒドロキシ-4-(p-置換)フェニルチアゾール-2(3H)-チオン類のオキソバナジウム(IV)及びジンク(II)錯体の合成とそれらのインスリン様活性

Oxovanadium(IV) and zinc(II) complexes with five kinds of 3-hydroxy-4-(p-substituted)-phenylthiazole-2(3H)-thiones as bidentate ligands were newly synthesized. Zinc(II) complexes showed approximately 15 times higher *in vitro* insulin-mimetic activities than that of ZnSO₄ as a positive control. Oxovanadium(IV) complexes also exhibited *in vitro* insulin-mimetic activities, in which a correlation between the activity and the Hammett's constant of the substituent R was found. Among zinc(II) complexes, bis [2,3-di-

hydro-2-thioxo-4-(p-nitrophenyl)-(6a) and bis [2,3-dihydro-2-thioxo-4-(p-chlorophenyl)-3-thiazololato]zinc(II) (6b) substantially lowered the blood glucose levels in KK-A^y mice. Oral glucose tolerance tests for 6a and 6b indicated the improvement of the diabetic states of animals.

Y. Matsumura and A. Katoh : “Synthesis of 2,3-Dimorpholino-6-aminoquinoxaline Derivatives and Application to a New Intramolecular Fluorescent Probe”, *J. Lumin.*, Vol. 128, pp.625-630, 2008.2.

邦文題目：2,3-ジモルホリノ-6-アミノキノキサリン誘導体の合成とその新規分子内蛍光プローブへの応用

Two fluorescent monomers having a quinoxaline skeleton, N-(2,3-dimorpholinoquinoxalin-6-yl)acrylamide (QxA) and N-(1-(2,3-dimorpholinoquinoxalin-6-ylamino)prop-2-yl) methacrylamide (QxAlaMA), were synthesized. Thermo-responsive copolymers of N-isopropylacrylamide (NIPAM) and a small amount of a fluorescent monomer were synthesized and their fluorescence properties investigated. The fluorescent monomers showed intense solvatochromism in their fluorescence. The wavelength at the maximum fluorescence intensity of the QxAlaMA-labeled PNIPAM dramatically blue-shifted and the fluorescence intensity of the QxA-labeled PNIPAM significantly increased around the transition temperature. It was found that these fluorescent dyes can sense and report the thermo-responsive behavior of the PNIPAM in water. Both QxAlaMA and QxA were demonstrated to be applicable to new intramolecular fluorescent probes.

R. Saito, S. Machida, S. Suzuki, and A. Katoh : “Synthesis and Spectroscopic Properties of 2,5-Bis

(benzoazol-2-yl)pyrazines”, *Heterocycles*, Vol. 75, No. 3, pp.531-536, 2008.3

邦文題目：2,5-ビス(ベンゾアゾール-2-イル)ピラジン類の合成と分光学的性質

A class of *p*-conjugated 2,5-bis(benzoazol-2-yl)pyrazine dyes have been synthesized in which 2,5-bis(benzimidazol-2-yl)pyrazine (1) exhibits strong fluorescence in solution. The enhanced fluorescence of 1 with a base leads to future applications such as anion sensing feasible upon chemical modification.

P. S. Vijayanand, S. Kato, S. Satokawa, T. Kojima : “Copolymerization of 4-biphenyl methacrylate with glycidyl methacrylate: Synthesis, Characterization, thermal properties and determination of monomer reactivity ratios”, *Polymer Bulletin*, vol. 58, No.5-6, pp. 861-872, 2007.5

邦文題目：4-biphenyl methacrylate と glycidyl methacrylateの共重合：合成，キャラクタリゼーション，熱的特性とモノマー活性比の決定

The methacrylic monomer, 4-biphenylmethacrylate (BPM) was synthesized by reacting 4-biphenyl phenol dissolved in ethyl methyl ketone (EMK) with methacryloyl chloride in presence of triethylamine as a catalyst. The copolymers of BPM with glycidyl methacrylate (GMA) were synthesized by free radical polymerization in EMK solution at 70 ± 1 °C using benzoyl peroxide as a free radical initiator. The copolymerization behaviour was studied in a wide composition interval with the mole fractions of BPM ranging from 0.15 to 0.9 in the feed. The copolymers were characterized by FT-IR, ¹H-NMR and ¹³C-NMR spectroscopic techniques. The solubility was tested in various polar and non polar solvents. The molecular weight and polydispersity indices of the polymers were determined using gel permeation chromatography. The glass transition temperature of the copolymers increases with increase in BPM content. The thermogravimetric analysis of the polymers showed that the thermal stability of the copolymer increases with BPM content. The copolymer composition was determined using ¹H-NMR spectra. The monomer re-

activity ratios were determined by the application of conventional linearization methods such as Fineman-Ross ($r_1 = 0.392 \pm 0.006$, $r_2 = 0.358 \pm 0.007$, Kelen-Tudos ($r_1 = 0.398 \pm 0.004$, $r_2 = 0.365 \pm 0.013$) and extended Kelen-Tudos methods ($r_1 = 0.394 \pm 0.004$, $r_2 = 0.352 \pm 0.006$).

P. S. Vijayanand, S. Kato, S. Satokawa and T. Kojima : “Homopolymer and copolymers of with glycidyl methacrylate: synthesis, characterization, monomer reactivity ratios and thermal properties”, *European Polymer journal*, 43, pp.2046-2056, 2007.5

邦文題目：4-nitro 3-methylphenyl methacrylateの重合と glycidyl methacrylateとの共重合：合成，キャラクタリゼーション，モノマー活性比と熱的特性

The novel methacrylic monomer, 4-nitro-3-methylphenyl methacrylate (NMPM) was synthesized by reacting 4-nitro-3-methylphenol dissolved in ethyl methyl ketone (EMK) with methacryloyl chloride in the presence of triethylamine as a catalyst. The homopolymer and copolymers of NMPM with glycidyl methacrylate having different compositions were synthesized by free radical polymerization in EMK solution at 70 ± 1 °C using benzoyl peroxide as free radical initiator. The homopolymer and the copolymers were characterized by FT-IR, ¹H NMR and ¹³C NMR spectroscopic techniques. The solubility tests were tested in various polar and non-polar solvents. The molecular weight and polydispersity indices of the copolymers were determined using gel permeation chromatography. The glass transition temperature of the copolymers increases with increase in NMPM content. The thermogravimetric analysis of the polymers performed in air showed that the thermal stability of the copolymer increases with NMPM content. The copolymer composition was determined using ¹H NMR spectra. The monomer reactivity ratios were determined by the application of conventional linearization methods such as Fineman-Ross ($r_1 = 1.862$, $r_2 = 0.881$), Kelen-Tudos ($r_1 = 1.712$, $r_2 = 0.893$) and extended Kelen-Tudos methods ($r_1 = 1.889$, $r_2 = 0.884$).

K. Shiono, Y. Abe, H. Tanouchi, H. Utsugi, N. Takahashi, H. Hamano, T. Kojima and K. Yamada : “Growth and survival of arid land forestation species (*Acacia aneura*, *Eucalyptus camaldulensis* and *E. salubris*) with hardpan blasting”, J. Arid Land Studies, 17(1), pp.11-22, 2007.6

邦文題目：乾燥地におけるハードパン破壊植林木 (*Acacia aneura*, *Eucalyptus camaldulensis*, *E. salubris*) の成長と生存：

The hardpan layer which occurs near the soil surface is widely found in arid land around the middle part of Western Australia. Hardpan layer is a highly compacted soil layer. Therefore, there has been concern that hardpan layer inhibits the planted tree growth and reduce survival ratio. To improve the growth and to increase the survival of planted trees in the area having hardpan layer, a new tillage technique using dynamite to blast hardpan layer, called hardpan blasting, was carried out at the Sturt Meadows station in Western Australia. During 67 months, we monitored the growth and the survival ratio of the tree species, *Acacia aneura*, *Eucalyptus camaldulensis* and *E. salubris*, at the hardpan-blasted plot and the nonblasted plot (i.e., natural condition) in the forestation site. At 67 month after planting, survival ratios of *A. aneura*, *E. salubris* and *E. camaldulensis* at the blasted plot were 46%, 54% and 20% increased than these at the nonblasted plot, respectively. Moreover, the mean heights of *A. aneura*, *E. salubris* and *E. camaldulensis* at the blasted plot were 13%, 10% and 72% higher than in the nonblasted plot, respectively. At the blasted plot, growth rate of *A. aneura*, *E. salubris* and *E. camaldulensis* were 0.17, 0.05 and 1.26 [kg month⁻¹], respectively. At the nonblasted plot, the growth rate of *A. aneura*, *E. salubris* and *E. camaldulensis* were 0.12, 0.03 and 0.17 [kg month⁻¹], respectively. Only, *E. camaldulensis* showed a significantly higher mean of aboveground biomass (W2005) and relative growth rate (RGR) at the blasted plot than at the nonblasted plot (P<0.05). There results suggested that hardpan blasting improved the growth of *E. camaldulensis*, however, did not im-

prove these of *A. aneura* and *E. salubris*. Moreover, *E. camaldulensis* showed the highest biomass production in the three tree species at the nonblasted plot as well as at the blasted plot. These results in this study give new information about the tree survival and growth under hardpan blasting forestation. These results are available for tree species selection for the forestation in the arid land having hardpan layer.

F.H. Marga, S.A.-H.M. Abdel-Hameed, S. Kato, S. Satokawa and T. Kojima : “Effect of ZrO₂ addition on Vickers Hardness of Modified Basalt Glass-Ceramics”, J. Ceramic Soc. Jpn., 115(7), pp.429-433, 2007.7

邦文題目：Basaltを用いたガラスセラミックスのビッカース硬度へのジルコニア添加効果

Improvement of mechanical properties of cordierite glass-ceramics using modified Egyptian basalt rocks by addition of different amounts of zirconia (ZrO₂) was investigated. Crystallization behavior of modified basalt glass was studied by X-ray diffraction (XRD) and scanning electron microscope (SEM). The Vickers hardness of glass-ceramics containing different amounts of ZrO₂ and formed at 1050°C for various heat-treatment time was compared. Toughness of the glass-ceramics increased with in increasing amount of transformable ZrO₂, which process is probably caused by crack deflection due to the high stress field around transformed ZrO₂

塩野克宏, 安部征雄, 河原崎里子, 濱野裕之, 田内裕之, 小島紀徳, 山田興一：「酸素安定同位体分析によるハードパン破碎土壤に植林された樹木の水源深度の推定」水文・水資源学会誌, 20(5), pp.409-423, 2007.9

ハードパン破碎を伴った植林法のための適種選抜は、ハードパンが分布する乾燥地での植林の成功に重要である。ハードパン破碎による成長改善には種間差があり、*Eucalyptus camaldulensis*で改善されるが、*Acacia aneura*では改善されない。この原因として、ハードパン破碎により土壤水分状態が改善された深い土層を水源とする能力の種間差が予想されていた。本研究では、ハードパン破碎区と非破碎区（自然状態）における、灌漑前後の深度別の土壤体積含水率の測定と、土壤と植林木の抽出水、灌漑

水、井戸水の酸素安定同位体比の分析により、2樹種の主な水源の深さを推定した。非破碎区では、両樹種ともに、厚いハードパン層のある深度20 [cm] よりも浅い土層を主な水源としており、灌漑前のこの土層は乾燥していた。しかし、灌漑前にも、破碎区の深度100 [cm] より深い土層は湿潤状態にあった。破碎区の *E. camaldulensis* は、この深度100 [cm] よりも深い土層の水を主な水源としていた。しかし、*A. aneura* は破碎区でも深度100 [cm] より浅い土層を主な水源としており、深い土層の水を有効利用していなかった。本研究により、深い土層 (>100 [cm]) の水を主な水源として利用できる樹種は、ハードパン破碎により成長改善されることが推察できた。

T. A. Gad-Allah, S. Kato, S. Satokawa, T. Kojima :
“Role of core diameter and silica content in photocatalytic activity of $\text{TiO}_2/\text{SiO}_2/\text{Fe}_3\text{O}_4$ composite”, Solid State Sciences, 9, pp.737-743, 2007.9

邦文題目 : $\text{TiO}_2/\text{SiO}_2/\text{Fe}_3\text{O}_4$ コンポジットの光触媒活性における核径およびシリカ含有分の役割

Magnetically separable $\text{TiO}_2/\text{SiO}_2/\text{Fe}_3\text{O}_4$ composites of different core (Fe_3O_4) diameters and silica contents have been prepared by sol-gel technique for both silica and titania coatings. Energy dispersive X-ray fluorescence (EDX), X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), BET surface area analysis and scanning electron microscope (SEM) have been used for characterization of prepared samples. Photocatalytic activity of the prepared samples has been investigated by photodegradation of methyl orange. Obtained results have shown that 25e45 mm core diameter exhibits the maximum activity since it possesses a convenient surface area and light transmittance. Silica content has a significant effect on the activity of composite. Silica content of more than 10 wt% has reduced the catalyst activity because of the increase in particle diameter and reduction of surface area.

P. S. Vijayanand, S. Kato, S. Satokawa and T. Kojima :
“Copolymerization of 4-cyanophenyl methacrylate with Methyl Methacrylate : Synthesis, Characterization and Determination of Monomer Reactivity Ra-

tios”, *Polymer Bulletin*, 59, pp. 469-480, 2007.11

邦文題目 : 4-cyanophenyl methacrylate と Methyl Methacrylate の共重合 : 合成, キャラクタリゼーション, 熱的特性とモノマー活性比の決定

A novel methacrylic monomer, 4-cyanophenyl methacrylate (CPM) was synthesized by reacting 4-cyanophenol dissolved in methyl ethyl ketone (MEK) with methacryloyl chloride in the presence of triethylamine as a catalyst. Copolymers of CPM with methyl methacrylate (MMA) at different composition was prepared by free radical solution polymerization at 70 ± 1 °C using benzoyl peroxide as initiator. The copolymers were characterized by FT-IR, ^1H -NMR and ^{13}C -NMR spectroscopic techniques. The solubility of the polymers was tested in various polar and non polar solvents. The molecular weight and polydispersity indices of the copolymers were determined using gel permeation chromatography. The glass transition temperature of the copolymers increases with increase in mole fraction of MMA content. The thermal stability of the copolymer increases with increases in mole fraction of CPM content in the copolymer. The copolymer composition was determined by using ^1H -NMR spectroscopy. The monomer reactivity ratios estimated by the application of linearization methods such as Fineman-Ross ($r_1=2.524 \pm 0.038$, $r_2=0.502 \pm 0.015$), Kelen-Tudos ($r_1=2.562 \pm 0.173$, $r_2=0.487 \pm 0.005$) and extended Kelen-Tudos methods ($r_1=2.735 \pm 0.128$, $r_2=0.4915 \pm 0.007$).

堀 雅文, 若林 洋, 藤井隆夫, 小島紀徳 : 「ダム堆積物の嫌気性分解速度の測定と必要排砂頻度の推定」, 環境技術学会, 36 (11) pp.803-808, 2007.11

本研究で対象とした富山県黒部川出し平ダムなどの排砂式のダムではダム機能を維持するため、ダム堰堤に建設された排砂ゲートからダム湖堆積物を下流に排出することを前提として設計されている。ダム湖堆積物は、時間の経過とともに嫌気性分解が進行するため、排砂した場合の下流域での生態系への被害を最小限度に押さえる必要性から、嫌気性分解が始まる前に排出することが望ましい。本研究は、ダム湖堆積物が嫌気性分解を活発に起こし始めるまでの期間の温度依存性について検討することにより、

ダム排砂の頻度決定の指針を与えることを目的とした。富山県黒部川に建設された出し平ダム湖から採取した堆積物を使用し、カラム実験と回分実験を試みた。カラム実験の結果、水温15℃の場合は水温25℃の場合より、嫌気性分解反応速度が約1/3倍となることがわかった。また、回分実験の結果から25℃では、実験開始後約30日間で嫌気性分解が始まることがわかった。これらの実験と湖水温の経年変化から、出し平ダムでは、毎年、湖水温度が上昇する夏前に定期的に排砂することが必要であるとの結論を得た。

堀 雅文, 若林 洋, 山本圭介, 加藤 茂, 小島紀徳:「ダム排砂が魚介類に与える影響の評価」, 日本海水学会, 61(6), pp.352-359, 2007.12

1993年12月に行われた黒部川出し平ダムからの排砂では、排出された底泥により下流域の漁業に深刻な影響を与えた。そのため、下流域漁業への影響を軽微に押さえる排砂方法に関する検討が必要となった。そのため、黒部川出し平ダムからの排砂、およびダム湖堆積物による濁水が魚介類に与える影響を観察した。魚種により濁水濃度と影響の関係は異なる。イワナ、ヤマメ、シロザケ、エゾアワビでは、排砂の濁水が原因と思われる斃死は発生しなかった。イワナ、ヤマメ、シロザケについては、河川の濁水濃度のピーク時(SS濃度8,000mg/L)にはヘモグロビン値の上昇がみられたが、SS濃度の低下に伴って、1日後には通常範囲内まで回復した。湖底泥濁水に対して、マダイ、ブリは忌避し、SS濃度低下後には回帰する傾向がみられ、シロギス、クロソイは忌避する傾向はみられなかった。

濱野裕之, 金親 暁, 河原崎里子, 田内裕之, 加藤 茂, 小島紀徳:「西豪州塩害農地での植林を目的とした簡易耐塩性試験による樹種特性の把握および適用方法の検討」, 日本海水学会誌, 62, pp.22-27, 2008.1

塩害地域での植林における最適樹種選択を目的とし、樹木の対塩性評価を行った。西豪州小麦ベルト地帯では、原生林が伐採され穀物生産農地に転換されたため、地下水位の上昇を招き、表面に塩が集積するようになった。このような土地を修復するには、部分的であれ植林することが要求される。さらには、成長速度の速い木は、大気中二酸化炭素濃度を減少させ、気候変更問題を緩和する。本研究では、12樹種について灌水中塩濃度を定期的に増大させることにより生存限界を実験的に定めると共に、淡水灌水

条件についても比較を行った。成長速度は樹高により評価した。塩水灌水条件で高い生残率を示した樹種は、一般的に塩水灌水条件では低い成長速度を示し、また淡水灌水条件下での最終重量も低かった。しかしながら、本研究で検討した樹種の中では唯一、自然環境下での掛け合わせ樹種である *Eucalyptus ludis x Eucalyptus camaldulensis* のみは、塩水灌水条件での高い生残率と高い成長速度を示した。

D. Boraha, S. Satokawaa, S. Katoa and T. Kojima: "Surface-modified carbon black for As(V) removal", J. Colloid Interface Sci., 319, pp.53-62, 2008.1

邦文題目: 表面修飾したカーボンブラックの5価ヒ素除去への応用

This paper reports the results of the adsorption performance of As(V) removal by a commercial carbon black and its H₂SO₄-modified form in a single-ion situation. The influence of different process parameters and the physicochemical principles involved were studied in detail. Acid modification caused morphological changes in the virgin carbon black as evidenced by BET surface area measurements and SEM study. FTIR spectra showed the introduction of sulfonic acid group in the parent carbon due to H₂SO₄ treatment. TGA analysis revealed higher weight loss characteristics of the modified carbon, demonstrating the creation of functional groups. The point of zero charge (pHpzc) of the modified carbon black is highly acidic (3.5) compared to commercial carbon black (6.4). It directly infers the generation of acidic functional moieties in the carbon black. The adsorption experiments were carried out following batch equilibrium techniques. The kinetics and thermodynamics of adsorption were investigated to unveil the mechanism and nature of the adsorption process, respectively. The kinetic parameters of different models were calculated and discussed. The kinetics of adsorption can be expressed by a pseudo-second-order model and intraparticle diffusion was not the rate-determining step. Dependence of pH on adsorption showed maximum metal uptake in the range of 4–5 and inferred surface complexation as the principal mechanism of adsorption. The equi-

librium adsorption data were modeled using Freundlich, Langmuir, and Dubinin–Kaganer–Radushkevich (DKR) isotherm equations and the corresponding isotherm parameters were calculated and discussed in detail.

D. Borah, S. Satokawa, S. Kato, T. Kojima :
“Characterization of chemically modified carbon black for sorption application”, *Applied Surface Science* Volume 254, Issue 10, Pages 3049-3056, 2008.3

邦文題目：吸着剤としての応用を目的とした表面化学修飾したカーボンブラックのキャラクタリゼーション

A commercial grade carbon black was chemically modified using mineral acids (either with HNO_3 or H_2SO_4 or mixture) and the sorption performance of the virgin and modified forms were investigated. Chemical modification resulted in the creation of surface acidic functional groups (COOH , SO_2OH) and was verified by FTIR spectra. This was further verified by TGA analysis revealing higher weight loss characteristics of the modified carbons in comparison to virgin carbon black. Morphological changes were observed from BET surface area measurements and SEM analysis. XRD study revealed the change of graphitic crystallite size as a result of modification. The suspension pH of the materials in deionized water and the point of zero charge (pHpzc) in inert electrolyte were determined. The measured values of suspension pH and pHpzc for all the carbons were found to be acidic with more acidic character in the modified carbons. These materials were used as sorbents for the removal of arsenic from aqueous medium and showed excellent adsorption performance. # 2007 Published by Elsevier B.V.

J. Fujimoto, T. Ishikawa, Y. Kurihara, M. Jimbo, T. Kon, M. Kuroda : “Two-body and three-body decays of charginos in one-loop order in the MSSM”, *Physical Review, D75*: pp.113002(1)-(14), 2007.6

邦文題目：ミニマル超対称性理論模型におけるチャージーノの2体および3体崩壊幅の1ループ補正

We present the renormalization scheme used in and the characteristic features of GRACE/

SUSY-loop, the package of the program for the automatic calculation of the minimal supersymmetric standard model processes including one-loop order corrections. The two-body and three-body decay widths of charginos in one-loop order evaluated by GRACE/SUSY-loop are shown.

N. Sasaki, A. Toyoda, N. Itamura, K. Miura :
“Simulation of Nanoscale Peeling and Adhesion of Single-Walled Carbon Nanotube on Graphite Surface”, *e-J. Surf. Sci. Nanotech.* Vol.6, pp.72-78, 2008.2

邦文題目：グラファイト表面上の単層カーボンナノチューブのナノスケール引き剥がしと凝着のシミュレーション

We have performed molecular mechanics study of nanoscale peeling and adhesion processes of carbon nanotube (CNT) on the rigid graphite surface. First, as a model of CNT, single-walled carbon nanotube (SW-CNT) of the (3,3) armchair type with a length of $\ell=99.3\text{\AA}$ comprised of 480 carbon atoms is used. In the simulation CNT physically adsorbed on the graphite substrate is peeled (retracted) from the surface and then adsorbed (approached) onto the surface. We have first obtained the vertical force-distance curve with the characteristic hysteresis loop derived from the bistable states between the line- and point-contacts during the peeling and adhesion processes. The analysis of the vertical and lateral force curves reveals that the CNT shows multiscale mechanics -- both nanoscale mechanics on the order of CNT's length ($\approx 100\text{\AA}$) and atomic-scale mechanics on the order of CNT's diameter ($\approx \text{several \AA}$). Next the effect of the CNT length ℓ on the peeling process is studied. As the CNT becomes shorter, discrete jump of the force curve vanishes and the peeling force curve exhibits continuous behavior because the shorter CNT becomes stiffer. Lastly the effect of the chirality of the CNT on the peeling and adhesion processes is studied for the armchair, zigzag and chiral type CNTs for the length of about $50\text{\AA}$. The hysteresis of the peeling curve shows the slight difference of the adhesive behavior among different chirality of CNTs.

M. Harada, M. Tsukada, N. Sasaki : “Energy Dissipation Mechanism of Non-Contact Atomic Force Microscopy for Movable Objects”, e-J. Surf. Sci. Nanotech. Vol.6, pp. 1-6, 2008.2

邦文題目：可動物体に対する非接触原子間力顕微鏡のエネルギー散逸機構

The energy dissipation in non-contact atomic force microscopy (NC-AFM) caused by the hysteresis loop of the potential energy between a tip and a sample with respect to the tip height is investigated in detail by the case studies for models of a graphite flake with a diamond tip. One of the models is made up of a graphite flake on a graphite surface. In this case, the hysteresis is caused by the difference of the lateral positions of the flake during the upward and the downward motion of the tip. The other model is made up of a graphite flake edge. In this model, the hysteresis is caused by the difference of the vertical positions of the flake edge during the upward and the downward motion of the tip.

N. Sasaki, N. Itamura, K. Miura : “Simulation of Atomic-Scale Ultralow Friction of Graphite/C60/Graphite Interface along $[10\bar{1}0]$ Direction”, Jpn. J. of Appl. Phys. Vol.46, pp. L1237-L1239, 2007.12

邦文題目：グラファイト/C60/グラファイト界面の $[10\bar{1}0]$ 方向の原子スケール超低摩擦のシミュレーション

The graphite/C60/graphite interface plays an important role in the atomic-scale ultralow friction of C60 intercalated graphite. In this study, the frictional feature along the $[10\bar{1}0]$ direction of the graphite/C60/graphite interface is numerically investigated and compared with that of the graphite/graphite/graphite interface. Simulated interlayer distances of about 1.3~nm are in good agreement with previous experimental results. The atomic-scale friction coefficient of the graphite/C60/graphite interface decreases to about 30% of that of the graphite/graphite/graphite interface. It is clarified that the three-dimensional degree of freedom of intercalated C60 motion is one of the origins of the ultralow friction of the graphite/C60/graphite interface along the $[10\bar{1}0]$ direc-

tion.

N. Sasaki, N. Itamura, K. Miura : “Atomic-Scale Ultralow Friction — Simulation of Superlubricity of C60 Molecular Bearing”, J. of Phys.:Conference Series Vol.89, pp. 01200101-0120010, 2007.11

邦文題目：原子スケール超低摩擦 -- C60分子ベアリングの超潤滑のシミュレーション

Simulation of superlubricity of C60 molecular bearing is performed based on molecular mechanics. Atomic-scale frictional feature along $[10\bar{1}0]$ direction of the graphite /C60/graphite interface is numerically investigated compared with that of the graphite/graphite/graphite interface. Simulated interlayer distances of about 1.3nm are in good agreement with previous experimental results[1-3]. Atomic-scale friction coefficient of graphite/C60/graphite interface decreases to about 30% of that of the graphite/graphite/graphite interface. It is clarified that three-dimensional degree of freedom of intercalated C60 motion is one of origins of ultralow friction of graphite/C60/graphite interface along $[10\bar{1}0]$ direction.

M. Ishikawa, M. Kato, R. Harada, N. Sasaki, K. Miura : “Chaotic behavior appearing in dynamic motions of nanoparticles”, J. of Phys.: Conference Series Vol.89, pp. 01200501-01200509, 2007.11

邦文題目：ナノ粒子の動力学に現れるカオスの振る舞い

The case of one-directional motion, under which graphite and mica flakes are driven on an octamethylcyclotetrasiloxane (OMCTS) liquid surface, is presented. The dynamical forces needed to move these bodies increase linearly with the logarithm of scanning velocity, which are typical energy dissipation process. A transition from quasi-periodic to chaotic motions occurs in the dynamics of a graphite flake when its velocity is increased. The dynamics of graphite flakes pulled by the nanotip on an OMCTS liquid surface can be treated as that of a nanobody on a liquid. On the other hand, there do not appear chaotic motions in the dynamics of a mica flake because the contact area between a mica flake and an OMCTS

liquid surface is larger than that between a graphite flake and an OMCTS liquid surface.

M. Harada, M. Tsukada, N. Sasaki : “Theoretical Simulation of Atomic Force Microscopy of Graphite Flake on Graphite Surface”, *e-J. Surf. Sci. Nanotech.* Vol.5, pp. 126-131, 2007.10

邦文題目：グラファイト表面におけるグラファイトフレークの原子間力顕微鏡の理論シミュレーション

We present results of theoretical simulations of atomic force microscopy (AFM) for the systems consisting of a graphite flake on a graphite substrate with a diamond tip. How are atomic sliding motions of the sample reflected on AFM images? This central issue was investigated by changing tip height and size of the flake which was located on the substrate surface and placed in a vacancy on the surface. When the tip height becomes higher, the flake motion induced by the tip changes from the swinging motion centered at one local potential minimum to the slipping motion between local potential minima. At the same time, the image changes from the one reflecting flake feature to the one reflecting surface feature. When the flake size changes, the inverse of image contrast is seen. When the flake is in a small vacancy, a ring shaped image is seen, which reflects the rotational motion of the flake induced by the tip motion. When the flake is in a large vacancy, the image is a combination of a ring shaped one and a noisy ribbon like one caused by the lateral movement of the flake.

K. Miura, D. Tsuda, N. Itamura, N. Sasaki : “Superlubricity of Fullerene Intercalated Graphite Composite”, *Jpn. J. of Appl. Phys.* Vol.46, pp. 5269-5274, 2007.8

邦文題目：フラーレン封入グラファイト化合物の超潤滑

Novel superlubric system of fullerene intercalated graphite composite is reported. First it is clarified that fullerene intercalated graphite films exhibit ultralow average friction force, and excellent friction coefficients smaller than for MoS₂ and for graphite. Next it is demonstrated that superlubricity can be controlled by intercalant

species. C60 intercalated graphite film shows much less maximum static friction force than C70 intercalated one. Finally we propose one of the simple guidelines of designing practical superlubric system -reduction of the contact area between intercalated fullerene and graphite sheet to the point-like contact. Our newly developed superlubric system will contribute to solving the energy and environmental problems.

K. Urasaki, Y. Fukuda, Y. Sekine, M. Matsukata, E. Kikuchi : “Hydrogen Production by Steam Reforming of Ethanol over Co/La_{1-x}Sr_xBO₃ (B = Al, Cr, Mn, Fe) Catalysts”, *Journal of Japan Petroleum Institute*, Vol. 51 No.2 pp.83-87, 2008.3

邦文題目：Co/La_{1-x}Sr_xBO₃ (B = Al, Cr, Mn, Fe)触媒を用いたエタノール水蒸気改質反応による水素製造

The steam reforming of ethanol for producing hydrogen was performed over 5 wt% Co catalysts supported on perovskite-type oxides, La_{1-x}Sr_xBO₃ (B = Al, Cr, Mn, Fe, x = 0 - 0.2) at 823 K with a molar H₂O/C₂H₅OH ratio of 6. Co/LaAlO₃ showed the higher catalytic activity and stability than Co catalysts supported on LaCrO₃, LaFeO₃ and LaMnO₃. A molar La/Al ratio markedly affected on the stability of Co/LaAlO₃ catalyst and a molar La/Al ratio of 1 was the most suitable, suggesting that perovskite structure contributes to the appearance of catalytic activity and stability. It was found that the partial substitution of Sr²⁺ for La³⁺ in LaAlO₃ resulted in further remarkable improvement of catalytic activity and hydrogen yield. We consider that enhanced mobility of lattice oxygen in La_{1-x}Sr_xAlO_{3-δ} contributes to its more frequent participation in the oxidation of intermediates over metallic cobalt, leading to both high catalytic activity and stability of Co/La_{1-x}Sr_xAlO_{3-δ} in comparison with Co/LaAlO₃.

Toshiaki Tsukuda, Satsuki Maeda, Masahiko Yasui, Takeshi Tamane, Taro Tsubomura : “Structure of a Barium(II) complexes sandwiched by a Schiff base macrocycle”, *Bull. Chem. Soc. Jpn.*, Vol. 81, No.3, p.358, 2008.3

邦文題目： Schiff塩基を有する大環状配位子によるサンドイッチ型バリウム(II)錯体の構造

Barium complexes sandwiched by octaaza Schiff base macrocycle prepared by [2+2] condensation of diimine and phenanthroline dicarboxyaldehyde have been studied; ten-coordinate structure of the complex and increase of absorption intensity on coordination have been revealed.

Taro Tsubomura, yasuiro Ito, Satoshi Inoue, Yu Tanaka, Kenji Mastumoto, Toshiaki Tsukuda : “Strongly Luminescent Palladium(0) and Platinum(0) Diphosphine Complexes”, *Inorg. Chem.*, Vol. 47, No. 2, p. 481, 2008. 1

邦文題目：強発光を示すパラジウム(0)及び白金(0)－ジホスフィン錯体

The synthesis, structure, and photoluminescence of palladium(0) and platinum(0) complexes containing biaryldiphosphines, biphep (biphep = 2,2'-bis(diphenylphosphino)-1,1'-biphenyl) and binap (binap = 2,2'-bis(diphenylphosphino)-1,1'-binaphthyl) have been studied. X-ray structure analysis of [Pt(biphep)₂] revealed the distorted-tetrahedral geometry of the complex. The photophysical properties of the three complexes [Pd(biphep)₂], [Pt(biphep)₂], and [Pd(binap)₂] were investigated and compared with that of the previously reported [Pt(binap)₂] complex. The [Pd(biphep)₂] complex shows the strongest luminescence with a high quantum yield (38%) and a long lifetime (3.2 μs) in a toluene solution at room temperature. The luminescence should be due to metal-to-ligand charge transfer excited states. At room temperature, radiative rate constants of the four complexes show similar values. The difference in the luminescent properties should reflect the different nonradiative rate constants of the complexes. The temperature-dependence of the luminescence spectra and lifetime of the complexes were also discussed.

Munetaka Iwamura, Toshiaki Tsukuda and Makoto Morita : “Energy-Transfer Process in Crystals of Chiral and racemic double complex salts of [Co(ethylenediamine)₃][Tb(2,6-pyridinedicarboxylate)

]₃”, *Bull. Chem. Soc. Jpn.*, Vol. 80, No. 6, p.1140, 2007. 6

Luminescence and energy transfer reactions in double complex crystals of [Co(en)₃][Tb(dpa)₃] (en=ethylenediamine, dpa=2,6-pyridinedicarboxylate) were investigated, and compared between single crystal of rac-[Co(en)₃]³⁺·rac-[Tb(dpa)₃]³⁻ (double complexes salt of racemic [Co(en)₃]³⁺ and racemic [Tb(dpa)₃]³⁻) and Δ-[Co(en)₃]³⁺·rac-[Tb(dpa)₃]³⁻ (chiral [Co(en)₃]³⁺ and racemic [Tb(dpa)₃]³⁻ salt). The energy transfer rate constants from Tb³⁺ to Co³⁺ complexes were determined from the time profile of emission intensity of photo-excited Tb(III) ion in the double complex crystals. The decay profiles of rac-[Co(en)₃]³⁺·rac-[Tb(dpa)₃]³⁻ were analyzed by single exponential curves. On the other hand, the profiles of Δ-[Co(en)₃]³⁺·rac-[Tb(dpa)₃]³⁻ show double exponential curves. From the X-ray analysis of crystal structures, it was found that there is only one site for [Tb(dpa)₃]³⁻ in rac-[Co(en)₃]³⁺·rac-[Tb(dpa)₃]³⁻ crystal, and there are two site in Δ-[Co(en)₃]³⁺·rac-[Tb(dpa)₃]³⁻ crystal, i.e. Δ-[Tb(dpa)₃]³⁻ and Λ-[Tb(dpa)₃]³⁻ are put in different site in the crystal. The two rate constants obtained from the double exponential curve of Δ-[Co(en)₃]³⁺·rac-[Tb(dpa)₃]³⁻ are assigned to energy transfer rates from Δ-[Tb(dpa)₃]³⁻ and Λ-[Tb(dpa)₃]³⁻ in the crystal. Fine distance dependence could be determined from the obtained energy transfer rate constants and Tb-Co distances in the crystals according to the Dexter type electron exchange mechanism of energy transfer model. The energy transfer rate constants in the crystals are comparable in magnitude with energy transfer rates in quenching experiments in the [Tb(dpa)₃]³⁻·[Co(en)₃]³⁺ aqueous solution.

M. Nonaka, B. Y. Ma, M. Ohtani, A. Yamamoto, M. Murata, K. Totani, Y. Ito, K. Miwa, W. Nogami, N. Kawasaki, and T. Kawasaki : “Subcellular localization and physiological significance of Intracellular mann-binding protein”, *J. Biol. Chem.* Vol. 282, No. 24, pp.17908-17920, 2007. 6

邦文題目：マンナン結合タンパク質の細胞内局在と生理

的な重要性

Mannan-binding protein (MBP) is a C-type mammalian lectin specific for mannose and N-acetylglucosamine. MBP is mainly synthesized in the liver and occurs naturally in two forms, serum MBP (S-MBP) and intracellular MBP (I-MBP). S-MBP activates complement in association with MBP-associated serine proteases via the lectin pathway. Despite our previous study, the subcellular localization of I-MBP and its functional implication have not been clarified yet. Here, as an extension of our previous studies, we have demonstrated that the expression of human MBP cDNA reproduces native MBP differentiation of S-MBP and I-MBP in human hepatoma cells. I-MBP shows distinct accumulation in cytoplasmic granules, and is predominantly localized in the endoplasmic reticulum (ER) and involved in COPII vesicle-mediated ER-to-Golgi transport. However, the subcellular localization of either a mutant (C236S/C244S) I-MBP, which lacks carbohydrate-binding activity, or the wild-type I-MBP in tunicamycin-treated cells shows an equally diffuse cytoplasmic distribution, suggesting that the unique accumulation of I-MBP in the ER and COPII vesicles is mediated by an N-glycan-lectin interaction. Furthermore, the binding of I-MBP with glycoprotein intermediates occurs in the ER, which is glycan- and pH-dependent, and is affected by glucose-trimmed high-mannose-type oligosaccharides. These results strongly indicate that I-MBP may function as a cargo transport lectin facilitating ER-to-Golgi traffic in glycoprotein quality control.

D. Yamaguchi, N. Kawasaki, I. Matsuo, K. Totani, H. Tozawa, N. Matsumoto, Y. Ito, and K. Yamamoto : “VIPL has sugar-binding activity specific for high mannose-type N-glycans, and glucosylation of the α 1,2 mannotriosyl branch blocks its binding”, *Glycobiology* Vol. 17, No. 9, pp.1061-1069, 2007. 9

邦文題目 : VIPLは高マンノース型N-グリカン特異的な糖結合活性をつが, α 1,2-マンノトリオース分岐鎖のグルコシル化は糖結合活性を阻害する

VIP36-like protein (VIPL) was identified as an endoplasmic reticulum (ER) resident protein with homology to VIP36, a cargo receptor involved in the transport of glycoproteins inside cells. Although VIPL is structurally similar to VIP36, VIPL is thought not to be a lectin, because its sugar-binding activity has not been detected in several experiments. Here, recombinant soluble VIPL proteins (sVIPL) were expressed in *Escherichia coli*, biotinylated with biotin ligase and oligomerized with R-phycoerythrin (PE)-labeled streptavidin (SA). As measured with flow cytometry, PE-labeled sVIPL-SA bound to deoxymannojirimycin (DMJ)- or kifunensine (KIF)- but not to swainsonine (SW)-treated HeLaS3 cells in the presence of calcium. A surface plasmon resonance analysis showed that the avidity of sVIPL was enhanced after it formed a complex with SA. The binding of PE-labeled sVIPL-SA was abrogated by endo β -N-acetylglucosaminidase H treatment of the DMJ- or KIF-treated cells. Competition with several high-mannose-type N-glycans inhibited VIPL binding, and indicated that VIPL recognizes the Man α 1-2Man α 1-2Man sequence. Glucosylation of the outer mannose residue of this portion decreased the binding. Although the biochemical characteristics of VIPL are similar to those of VIP36, the sugar-binding activity of VIPL was stronger at neutral pH, corresponding to the pH in the lumen of the ER, than under acidic conditions.

N. Kawasaki, Y. Ichikawa, I. Matsuo, K. Totani, N. Matsumoto, Y. Ito, and K. Yamamoto : “The Sugar-Binding Ability of ERGIC-53 is Enhanced by its Interaction with MCFD2”, *BLOOD* Vol. 111, No. 3, pp.1972-1979, 2008. 2

邦文題目 : ERGIC53の糖結合活性はMCFD2との相互作用で向上する

Combined deficiency of factors V and VIII (F5F8D) is a bleeding disorder caused by mutations in LMAN1 or MCFD2. LMAN1 encodes ERGIC-53, a cargo receptor with an L-type lectin domain, and MCFD2 is a EF-hand-containing protein. We prepared a biotinylated, soluble form

of ERGIC-53, which we labeled with R-phycoerythrin conjugated streptavidin. By flow cytometry, sERGIC-53-SA bound to HeLaS3 cells in the presence of calcium but only after preincubation with MCFD2. Treating the cells with endo H or incubating them with high mannose-type N-glycan, especially M8B, abrogated sERGIC-53-SA binding. Surface plasmon resonance experiments demonstrated that MCFD2 specifically bound to sERGIC-53 and 2 MCFD2 mutants found in F5F8D patients had a K_a that was 3 or 4 orders of magnitude lower for sERGIC-53 than for wild-type MCFD2. The K_a of sERGIC-53 and MCFD2 was measured at several pH values and calcium concentrations, and we found that at a calcium concentration less than 0.2 mM, this interaction became significantly weaker. These results demonstrate that the binding of ERGIC-53 to sugar is enhanced by its interaction with MCFD2, and defects in this interaction in F5F8D patients may be the cause for reduced secretion of factors V and VIII.

K. Totani, Y. Ihara, I. Matsuo, and Y. Ito : “Effects of macromolecular crowding on glycoprotein processing enzymes”, *J. Am. Chem. Soc.* Vol. 130, No. 6, pp.2101-2107, 2008. 2

邦文題目：糖タンパク質プロセッシング酵素に対するマクロ分子クラウディング環境の影響

Intracellular environments are highly crowded due to the presence of various biomacromolecules. In this study, we estimated the property of the endoplasmic reticulum glucosidase II (G-II) under macromolecular crowding conditions. A crowded milieu that contains bovine serum albumin greatly enhanced the second trimming step (cleavage 2), which deglycosylates Glc1Man9GlcNAc2, but not the first trimming step (cleavage 1), which removes the terminal glucose residue from Glc2Man9GlcNAc2. A similar effect was obtained with ribonuclease A and high molecular weight polyethylene glycol 20,000. An analysis of CD spectra suggested that G-II enhanced its cleavage 2 activity through conformational change. We also investigated the effects of

molecular crowding on other N-linked glycan-processing enzymes, UDP-Glc:glycoprotein glucosyltransferase and 1,2- α -mannosidase. Our results indicate that the kinetics of glycan processing under crowded conditions may be quite different from those measured in dilute buffers.

S. Nakamura-Tsuruta, N. Uchiyama, W. J. Peumans, E. J. M. Van Damme, K. Totani, Y. Ito, and J. Hirabayashi : “Analysis of the sugar-binding specificity of mannose-binding Jacalin-related lectins by frontal affinity chromatography - an approach to functional classification”, *FEBS J.* Vol 275, No. 6, pp.1227-1239, 2008. 3

邦文題目：フロンタルアフィニティークロマトグラフィーを用いたJacalin由来マンノース結合レクチンの解析

The Jacalin-related lectin (JRL) family comprises galactose-binding-type (gJRLs) and mannose-binding-type (mJRLs) lectins. Although the documented occurrence of gJRLs is confined to the family Moraceae, mJRLs are widespread in the plant kingdom. A detailed comparison of sugar-binding specificity was made by frontal affinity chromatography to corroborate the structure-function relationships of the extended mJRL subfamily. Eight mJRLs covering a broad taxonomic range were used: Artocarpin from *Artocarpus integrifolia* (jackfruit, Moraceae), BanLec from *Musa acuminata* (banana, Musaceae), Calsepa from *Calystegia sepium* (hedge bindweed, Convolvulaceae), CCA from *Castanea crenata* (Japanese chestnut, Fagaceae), Conarva from *Convolvulus arvensis* (bindweed, Convolvulaceae), CRLl from *Cycas revoluta* (King Sago palm tree, Cycadaceae), Heltuba from *Helianthus tuberosus* (Jerusalem artichoke, Asteraceae) and MornigaM from *Morus nigra* (black mulberry, Moraceae). The result using 103 pyridylaminated glycans clearly divided the mJRLs into two major groups, each of which was further divided into two subgroups based on the preference for high-mannose-type N-glycans. This criterion also applied to the binding preference for complex-type N-glycans. Notably, the result of cluster

analysis of the amino acid sequences clearly corresponded to the above specificity classification. Thus, marked correlation between the sugar-binding specificity of mJRLs and their phylogeny should shed light on the functional significance of JRLs.

(以上5件 戸谷希一郎 前職(独)理化学研究所 基礎科学特別研究員およびCREST研究員における実績)

中野武雄・星堅一郎・馬場 茂:「窒化チタンの反応性スパッタ製膜における真空環境の影響」真空, Vol.50, No.4, pp.291-293, 2007.4

The effect of background gas environment on the purity of reactively-deposited nitride films has been studied. Especially, the relation between

the oxygen background pressure and its incorporation into the TiN film is investigated in this study. We have developed a UHV sputtering system and deposited TiN films under two different base pressure conditions: one was a UHV condition less than 10^{-6} Pa, and the other was 1×10^{-4} Pa of oxygen. The oxygen content of the films was examined with X-ray photoelectron spectroscopy. While no trace of oxygen was detected in the TiN film deposited under the UHV condition, 10 at.% of oxygen was observed in that deposited with the O_2 introduction. The extent of O_2 incorporation into the TiN film is discussed based on the difference in sticking characteristics of oxygen and nitrogen on the titanium surface.

情 報 科 学 科

Y. Saeki, M. Aoki: "Driver monitoring using a far infrared camera", Proceedings of the IEEE Image Electronics and Visual Computing Workshop 2007

It is said that there are 90% or more traffic accident caused by human error of a driver. Detecting the abnormal circumstances of a driver at an early stage will prevent human error. In this study, we set a far infrared camera in the inside of car and monitor a driver. The purpose of this study is to make a system that detects and tracks a face position of a driver in the inside of car where an illumination condition is not stable. We tracked a face position of a driver by performing the detection of a candidate head domain using template matching.

N. Toda, M. Aoki: "Driver's gaze detection", Proceedings of the IEEE Image Electronics and Visual Computing Workshop 2007

We propose a method to estimate the Driver's gaze using a video camera. First gaze detection process is transform into binary image for extracted black part of an iris. And next step is extraction of border for perform circle detection Hough transform. And third step is circle detection Hough transform for detect circle shape of iris, nostril and eye's outline. Location of iris,

nostril and eye's outline are decided by this process. After third step, we proposed to tracked gaze by Kalman filter using location, velocity and acceleration. And gaze is estimated by connection with location of iris, nostril and eye's outline. And we assume that distance of subject's gaze can be estimated by considering the eye model.

M. Nakayama, Y. Saeki, S. Katahara, M. Aoki: "Driver face detection using low resolution far infrared image", Proceedings of the IEEE Image Electronics and Visual Computing Workshop 2007

Face position and direction gives a good cue for driver vigilance and alertness. In this paper we propose a driver face detection algorithm using low resolution (8×6) far infrared image. We assumed that the highest temperature position represents a good candidate of face position. The trace of this position indicates facial movement and posture change. We applied the proposed algorithm to the low resolution far infrared image sequence of an actual driving situation taken from a camera installed on the top of an instrument panel. The result shows the feasibility and usefulness of the proposed algorithm in detecting face position. The face position information is also useful for air bag operation, specifically for child

in the passenger seat.

Atsuko Ikegami, Aki Uno : “Bounds for staff size in home help staff scheduling”, Journal of the Operations Research Society of Japan, Vol.50, No.4, pp.563-575, 2007

邦文題目：訪問介護スタッフスケジューリングにおけるスタッフ数の上下限値

Home help organizations provide services at respective users' homes at a time that is convenient for the user. Helpers with time window constraints for their working hours must be assigned to these services to ensure that the services are provided. Producing adequate schedules usually takes the schedulers a considerable amount of time due to many types of constraints and requirements. It is difficult even to estimate the number of helpers needed.

In this paper, we introduce a mathematical programming formulation of the home help staff scheduling problem, and propose two types of lower bounds for the number of helpers needed on a specific day. We then also calculate the number of helpers using a simple heuristic algorithm in order to determine the upper bound. Combining the bounds with the information obtained when determining the bounds was shown to be useful for arranging the appropriate helpers for each day before making a detailed schedule, even though each of the algorithms that obtains the bounds is very simple.

池上敦子, 森田隼史, 菊地 丞, 山口拓真, 中山利宏:「鉄道運賃計算のための最適経路探索」統計数理研究所共同研究レポート221「最適化：モデリングとアルゴリズム21」, pp.246-252, 2008.3

鉄道運賃は基本的に距離が長くなればなるほど高くなるように設定されているものの、同じ距離でも会社によって、さらには同じ会社内でも地域や路線によって、異なる金額が設定されている。さらに、乗車区間によっては割引ルールや特別運賃が設定されていることなどから、最短経路が最安運賃経路になるわけではない。また、利用者の乗車経路が明らかでない場合、最安運賃経路を利用したとみなして運賃を決定するので、与えられた2駅間の正しい運

賃を得るためには、その2駅間の利用可能経路のすべて、もしくは、その一部を列挙して判断する必要があることが、これまでに報告されてきた。

我々は、与えられた鉄道ネットワーク（1社のみのネットワークと、複数社を含むネットワークの両方の場合）の全2駅間の運賃計算に対し、ほとんど列挙を必要としないアルゴリズムを利用することにより、その処理時間の大幅な削減に成功した。

本稿では、1社内ネットワークでの運賃計算に話を絞り、その中でも、東日本旅客鉄道（JR東日本）を対象に、JR時刻表に掲載されている普通運賃に関する情報から、首都圏エリアのICカード乗車券 Suica/Pasmoの利用可能範囲（関東IC範囲）の全2駅間の最安運賃とその経路を得るアルゴリズムを紹介する。

岩崎 学・廉 民善:「ゼロトラクションのあるカウントデータの解析」,行動計量学, Vol. 34, No. 1, pp. 91-100. 2007. 4

ある事象の生起回数が0の度数は報告されず生起回数が1以上の度数のみが得られるときゼロトラクションが生じたという。本論文では、ゼロトラクションの下でのカウントデータの解析法を議論する。特に、2つの事象の生起回数間の関係を2変量のガンマポアソン分布でモデル化した場合の未知パラメータの推定法を与える。ここでは、データマイニングへの応用を意識し、推定法としてはなるべく簡便なものを与える。また、その手法をいくつかのデータセットに適用した結果を示すと同時に、もうひとつ別の問題、すなわち生起回数0の度数が報告されていたとしてもそれが必ずしも適切なものとは限らないことが現実のデータでは散見されることを指摘する。

岩崎 学・河田祐一:「処置前後研究における平均への回帰とその周辺」,日本統計学会誌シリーズJ, Vol. 36, No. 2, pp. 131-145. 2007. 4

新薬開発の臨床試験などでは、目的となる処置の効果の有無やその大きさを評価する際、同じ被験者に対し処置を施す前と施した後でデータを観測するいわゆる処置前後研究が行なわれることが多い。この種の研究デザインでは、「平均への回帰」現象が生じ、ともすると試験結果の解釈に重大な誤りをもたらすこともある。本論ではまず、平均への回帰がなぜ生じるのかに関する考察をベイズ流のモデルに基

づいて行なう。その上で、2変量正規分布のみならず、2変量ガンマポアソン分布および2変量ベータ二項分布のような離散分布でも同様の平均への回帰現象が見られることを指摘し、その種のデータの統計的推測法について議論する。

上田 徹:「数理計画法による継次カテゴリデータの解析法」日本オペレーションズ・リサーチ学会和文論文誌 (TORSJ), Vol.50, pp.68-81, 2007.12

西里は双対尺度法の(カテゴリに順序のある)継次カテゴリデータへの適用法を工夫しているが、その定式化は面倒である。しかし、継次性は数理計画法の制約として捉えればその表現は容易なので、まずMS Excelのソルバーで解ける程度の簡易な数理計画法としての定式化について述べている。数理計画法の利点は目的関数や制約の修正、追加が極めて容易なことであり、その特徴を生かして様々な目的関数について検討している。ところで、回答者に評価対象を主観的に評価してもらう場合はその評価結果は確定値ではなくこの程度といった曖昧さを持っているであろう。そこで、双対尺度法において曖昧さをモデルに持ち込むためにファジィ数を用いることも提案している。三つの回答例を用いて本論文で提案するモデルの有効性を確認している。

S. Mogaki, M. Kamada, T. Yonekura, S. Okamoto, Y.Ohtaki, M. Reaz : “Time-Stamp Service makes Real-Time Gaming Cheat-Free”, 6th Annual Workshop on Network and Systems Support for Games 2007, (NETGAMES2007), pp.135-138, (2007.9).

Assuming time-stamp servers that we can trust exist everywhere in the Internet, we propose a cheat-proof protocol for real-time gaming that has the minimum latency. The assumptions are: 1) Time-stamp servers are available near each player that issue serially numbered time stamps. 2) There is no communication break down between the player and the nearest time-stamp server. By this protocol, each player sends its own action to the other player and also sends its hash to the nearest time-stamp server. The time-stamp server sends back to the player the signed hash with time and a serial number involved. The signature is an undeniable evidence of the action. The actions are checked if they are compatible

with the hashes and the signed hashes are checked if they have the correct time and if the serial numbers are contiguous. This verification can be done as a batch after the game is finished. The latency in this protocol is only the packet traveling time from a player to another.

Y. Obu, M. Yamamoto, T. Yonekura, M. Kamada and S. Okamoto : “Exploring State Diagram-based Web Browser Programming”, Proceedings of the 2007 IEEE, International Conference on Cyberworlds, Hannover (2007.10)

Over the last few years a great deal of interest has focused on a major paradigm shift in World Wide Web-based services referred to as Web 2.0. In marked contrast to the earlier Web, in Web 2.0 sites become sources of information and functionality that enable users to create new content of their own. Consequently, users are now looking for more versatile browsers that will let them edit and display content based on their own preferences. This motivated us to develop a state diagram-based Web browser programming scheme that supports the close interaction between the end-user and Web content. Using state diagrams to represent browser behavior is easier for end-users with little or no programming experience to grasp than text-based programming systems.

岡本秀輔, 鎌田 賢, 米倉達広:「Web上の複数プレイヤー参加型オンラインRPGを簡易に作成するツール」, 電子情報通信学会技術研究報告, ISSN 0913-5685, 信学技報 Vol.107, No.129, pp.43-47, 2007.7

Webアプリケーションとして複数プレイヤー参加型RPGを簡易に作成するためのプログラミングツールについて述べる。このツールの設計目標は単純な指定でさまざまなRPGを作成できることである。プログラミングの初心者や小学生などもこのツールの対象ユーザに含めている。ツールはGUIエディタとコードジェネレータからなる。GUIエディタはRPGのキャラクタの動作を規定する状態遷移図を作成するためのものである。コードジェネレータは、ゲームを構成するためのC, PHP, JavaScript, HTMLなどのコードを状態遷移図から生成する。生

成されたRPGは、Firefox, Safari, IEといったよく使われるWebブラウザで操作できる。RPGのプレイヤーがWebブラウザ上でクリックやキー入力を行うと、その結果がWebサーバに送られデータベースに記録される。その結果、プレイヤーの入力が、他のプレイヤーのアバタやプレイヤーと関連を持たないゲームキャラクタに影響を与えることができ、さらにそれが他のプレイヤーの画面に反映される。状態遷移図は特定のプログラミング言語には依存せずに動作を規定するための道具である。そして、その構造は単純なために簡単に学習できるとともに、ゲームキャラクタの振舞指定に適している。本報告では、ツールを用いて容易にWeb用のRPGを作成できる可能性について述べる。

竹原陽道, 岡本秀輔, 鎌田 賢, 米倉達広:「状態遷移図を用いたロボット制御プログラミング」, 電子情報通信学会2種研究会 サイバーワールド(CW)第8回研究会, pp.5-8, 2007.12

レゴ社が開発したロボットMindstorms NXTを対象としたロボット制御プログラミング環境について述べる。この開発環境は状態遷移図を用いてロボットを制御する。そのため、プログラミング知らない子供でも使用することができ、対象ユーザはロボットを自分の思うように動かしてみたい人すべてである。本研究では、このツールの設計と実装に加えて、このツールを使用したロボット制御の可能性について述べる。

Shingo Yamakawa, Shohei Terada, Kunio Tojo, Yasuhiro Okazaki, Yu Kakishima, Dai Hanawa, Kimio Oguchi : “Traffic management for prioritized information in the next generation home network”, Proc. SPIE Vol. 6784, Network Architectures, Management, and Applications V, pp. 6784R-1 - 6784R-11, 2007.11

邦文題目 : 次世代ホームネットワークにおける優先情報に対するトラヒック制御法

This paper first classifies the sensing data in the next generation home network according to its level of importance. Traffic management for the data sent by various applications is then described, together with some simulation results. In the simulation, the proposed traffic management method controlled the data correctly.

D. Hanawa and T. Yonekura : “Improvement on the Accuracy of the Polynomial Form Extrapolation Model in Distributed Virtual Environment”, The Visual Computer, Springer-Verlag Berlin/Heidelberg, Vol.23, No.5, pp.369-379, 2007.5

邦文題目 : 分散仮想環境における多項式型外挿モデルの精度向上

In this paper, we studied the relationship between the accuracy of the extrapolating data and the update interval in a distributed virtual environment (DVE). We have already shown that numerical analysis can be applied to the extrapolating data between frames using parameters calculated from the data over the last several frames based on polynomial models. Based on the properties of the polynomial models, we proposed the new method to extrapolate the attribute data which arrives at a discrete time period. We showed that theoretical models which approximate the statistical error of extrapolating data can be formulated based on parameters such as the update interval and changes in the data. Theoretical models showed that the average error of the proposed method is less than that of current methods. Finally, we confirmed that the proposed method can improve the accuracy in comparison with current methods by conducting experiments with the motion of a pen for a series of letters written by a human.

Yasuki Sakurai, Masatoshi Takubo, Fumiaki Kato, Munenori Kai : “A Code Transformation Method For Strong Migration Mobile Agent”, Proc. of IEEE Pacific Rim Conference on Communications, Computers and Signal Processing (PACRIM' 07) , pp.485-488, 2007.8

In order to keep high efficiency, high reliability, and fault tolerance in a distributed processing system, we have been developing an autonomic distributed processing system by using a Java-based mobile agent system. Since we used a mobile agent system based on a weak migration mobility in our system, it was difficult for users to write an agent program freely which can resume its process on destination computer from the point at which it stopped just before moving. In

this paper, we propose a new source code transformation method for any strong migration mobile agent code. The method can transform the source code, which is easy to write for users, into the code to be executed on the ordinary JavaVMs(Java Virtual Machines).

尾高 輝・甲斐宗徳:「通信遅延を考慮したタスクスケジューリングのためのタスク粒度解析」,成蹊大学理工学研究報告, Vol.44, No.1, pp.17-23, 2007.6

タスクスケジューリング問題は, 強NP困難な組み合わせ最適化問題である。タスクスケジューリング問題においては, タスク集合はその先行制約を表現したタスクグラフで与えられる。その際, 先行後続関係にあるタスクが異なるプロセッサに割り当てられる場合には, そのタスク間にデータ通信時間を考慮する必要が生じる。従来のスケジューリング問題の解法ではそれらデータ通信時間は扱われていなかった。通信時間を考慮したタスクスケジューリング問題では探索空間がより広大化することになり, さらに解くことが難しい問題となる。本論文では, 解が存在しそうな探索空間を絞り込み, タスク融合によって探索時間を縮小するためのタスク粒度解析を提案する。この解析によって, 部分タスクグラフを構成する複数のタスクを1つのタスクに融合可能な, 基本的な構造と条件を明らかにした。また, 解として得られるスケジュール長をできる限り短くするため, 通信でネックとなるタスクを複製して通信を削除する方法も提案する。これら2つの手法を用いた探索アルゴリズムを, ランダムに生成されたタスクグラフを始め, ロボット制御, 疎行列乗算といった実際のアプリケーションや, SPEC fpccというベンチマークプログラムのタスク構造に適用し, 良好なスケジューリング結果が得られることを示す。

田久保雅俊・櫻井康樹・加藤史彬・甲斐宗徳:「強マイグレーションモバイルエージェントを実現するコード変換手法」,成蹊大学理工学研究報告, Vol.44, No.1, pp.25-33, 2007.6

筆者らは, これまでにAgentSphereと呼ぶ, Javaベースの強マイグレーションモバイルエージェントシステムを開発してきた。これは, ユーザが記述した強マイグレーションのエージェントコードを, 自動的に弱マイグレーションのエージェントコードにソースコード変換し, それから通常のJava仮想マシン

上で, 変換されたエージェントコードを実行できるようにしたものである。AgentSphereの最初のバージョンでは, 強マイグレーションエージェントのコードをステートメントレベルで変換していくものであったため, 変換後の実行効率が犠牲になる欠点を持っていた。本論文では, 新しいソースコードの変換手法を構築し, AgentSphereに組み込む手法を提案している。この新しいバージョンのAgentSphereでは, 強マイグレーションのソースコードは, マイグレーション命令を含む制御構造レベルでコード変換されることになり, 変換部分の処理オーバーヘッドが低減されてエージェントの処理性能を向上させることに成功した。

田中康之・三浦 純・甲斐宗徳:「C言語自動並列化トランスレータにおけるマクロタスク拡張」,成蹊大学理工学研究報告, Vol.44, No.1, pp.35-44, 2007.6

逐次処理用のC言語で記述されたプログラムを自動的に並列化するため, 一連の解析ステージが必要となる。それは, 並列性解析ステージ, 実行時間解析ステージ, タスク粒度解析ステージ, タスクスケジューリングステージ, 並列化コード生成ステージで構成される。これらのステージがスムーズに連携するためには, 全てのステージ間で共有できるリソースが必要である。著者らは, すでにCソースコード上にプラグマディレクティブを用いてステージ間で解析情報を受け渡すことができるような共有リソースを設計した。従来この共有リソースは, タスクの情報を表すソースコードインタフェース, 通信データに関する情報を持つ通信情報インタフェース, DOALLループに関する詳細な情報, スケジューリング結果といった個別のファイルに分かれていた。本論文では, ソースコード上でこれらのインタフェースが一元管理できるように情報を統合し, 並列化のための情報をすべてソースコード上のプラグマディレクティブに反映することを提案する。また, ソースコード中の階層的な制御構造をマクロタスクと捉え, そのマクロタスク内部のスケジューリング結果を導き出して全体のスケジューリングに利用するために, 各解析ステージの適用順序を階層的な構造に改良する方法も提案する。

神田芳文・鳴尾丈司:「軟式野球ボールとバットの衝突シミュレーション」,日本機械学会論文集, C編, Vol.73, No729, pp1307-1313, 2007-5

For a rubber baseball, which is a baseball made entirely of rubber, the softness of the ball makes it very difficult to increase the coefficient of restitution (COR) of the ball-bat impact by modifying the stiffness of the bat. In order to direct modification of the baseball bat, precise analysis of the impact phenomenon is required. In order to establish a powerful tool for analyzing the baseball-bat impact, numerical analysis programs based on the three-dimensional finite element method have been developed. After verifying the developed programs by comparing calculated and experimental results, the impact characteristics of an aluminum bat in collision with a rubber baseball were investigated precisely. The results show that the COR decreases with increasing impact velocity, and that the COR is greatly affected by the hoop rigidity of the barrel of the bat, which has a hollow shell structure. Moreover, at high impact velocities, the COR is maximized at an impact location about 600 mm from the end of the bat handle.

Taku Itoh and Yoshifumi Kanda : “An Application for Reconstructing Surfaces from 3D Scattered Point Data for Use on Dual-Core Systems”, In Proceedings of ICNAAM 2007, pp. 275-279, Corfu, 2007.9

本論文では、OpenMPを用いたデュアルコアシステム向けアプリケーション作成法の1つを述べている。本方法では、同一の目的を達成するための2つの異なる方法をOpenMPによって並列に使用する。具体例として、離散点群からの3次元形状再構成を達成するためのアプリケーションを作成した。同アプリケーションは、MPU(Multi-level Partition of Unity implicits)法とDelaunay分割法の両方法から成る。数値実験では、このアプリケーションが、MPU法のロバスト性とDelaunay分割法の高速度性を併せ持っていることを例証した。

S. Kuribayashi and S. Tsumura : “Optimal LSP selection method in MPLS networks”, Pacrim07, 2007.8
邦文題目 : MPLS網における最適LSP選択方式

Multi-Protocol Label Switching (MPLS) had been deployed by many data networking service providers because of its undeniable potential in

terms of virtual private network (VPN) management, traffic engineering, etc. In MPLS networks, IP packets are transmitted along a Label Switched Path (LSP) established between edge nodes. To improve the efficiency of resource use in MPLS networks, it is essential to utilize the LSPs efficiently.

This paper proposes an optimal LSP selection method in MPLS networks, on the assumption that both the upward and downward LSPs are established as a pair (both-way operation) and multiple LSP pairs are established between the same pair of edge nodes. It is supposed that the optimal LSP pair is selected from among multiple LSP pairs for each service request and both upward and downward bandwidths are allocated simultaneously in the selected LSP pair. It is demonstrated by simulation evaluations that the proposal method could reduce the total amount of the bandwidth required by up to 15% compared with the conventional selection method.

S. Tsumura and S. Kuribayashi : “Delayed resource allocation method for a joint multiple resource management system”, TPM2-3 APCC2007, 2007.10

邦文題目 : 資源割当て遅延を許容する複数種別資源同時割り当て方式

Abstract—In computer networks including the next generation network (NGN), both computing and network resources are required to be allocated simultaneously to each service request. It is possible to improve the efficiency of resource use if we delay the start of resource allocation rather than rejecting the request if required resources are not available when the request occurs.

This paper assumes that both computing and network resources are allocated per service request, and proposes a new joint resource allocation method that permits the start of resource allocation to be delayed if the required resources are not available, on condition that the service shall be completed within a maximum permissible service completion time. It is demonstrated by simulation evaluations that the proposed

method could reduce the total amount of resource required by up to 25% regardless of request generation patterns, compared with the conventional method without delayed resource allocation.

K. Hatakeyama, S. Tsumura and S. Kuribayashi : “Packet transmission control of preventing the perceptual video quality deterioration in all IP-based network”, ICOIN2008, 2008.1

邦文題目：オールIPネットワークにおいてユーザ視聴品質劣化を防止するパケット転送方式

Streaming media distribution services has been spreading rapidly, in which users view movies and music programs delivered over IP-based networks. In IP-based networks where resources are shared but cannot be reserved, it is difficult to prevent temporary congestion from occurring. Therefore, when temporary network congestion occurs, some packets will be discarded, resulting in the deterioration in the user's perceptual video quality.

This paper first evaluates the relationship between packet discarding patterns and perceptual video quality is evaluated, assuming the delivery of UDP-based MPEG2 streaming videos. Based on the evaluation, this paper proposes the optimal packet discarding patterns which do not lead to any deterioration in the perceptual video quality and indicates that the perceptual video quality deterioration can be avoided by selecting an appropriate packet discarding pattern, if the total number of discarding packets is less than several percent of all packets being generated. The practical applicability of the proposed method is also examined.

K. Hatakeyama and S. Kuribayashi : “Proposed congestion control method for all-IP networks including NGN”, ICACT2008, pp.1082-1087, 2008.2

邦文題目：NGNを含むオールIPネットワークにおけるふくそう制御方式

All-IP networks, including next generation networks (NGNs), in which IP technology is used to integrate all services, are being studied or introduced in earnest worldwide. To support any

services in all-IP networks, it is necessary to allocate both the computing resource (processing ability) and the network resource (bandwidth) simultaneously.

This paper discusses congestion control schemes for all-IP based networks, based on the joint allocation of multiple types of resources. This paper first analyzes congestion control schemes used in existing services and networks, and proposes basic principles on congestion control for all-IP networks, assuming the joint allocation of multiple types of resources. Next, two schemes are proposed to materialized a part of basic principles. First scheme is a flexible resource reallocation scheme in which a part of network resources not fully used in one center are reallocated to other center. Second scheme is a smart request restriction scheme to ease the congestion, which does not restrict all requests uniformly but restricts only those requests that require a large amount of resource of the congested resource type. Finally, we demonstrate the effectiveness of the proposed schemes by numerical computation and simulation evaluations.

黒田広樹・畠山賢一・栗林伸一：「ユーザ視聴品質劣化を回避するストリーミング配信パケット転送方式の評価」，成蹊大学理工学研究報告，Vol.44, No.1, pp.45-48, 2007

本論文は，UDPベースのMPEG2ストリーミング配信を前提に，パケット廃棄パターンとユーザ視聴品質の関係を評価し，その評価結果に基づきユーザ視聴品質を劣化させない最適なパケット廃棄方法とその実現条件を明らかにする。これにより，全転送パケット数の数%程度以下のパケット廃棄が必要な一時的なネットワーク輻輳であれば，パケット廃棄の仕方により品質劣化を回避することが可能となる。また，今回の評価は符号化速度6Mbps，特定メーカの符号化を前提に評価を実施したため，これら条件が変われば最適な廃棄パターンの数値も変化すると考えられるが，今回提案した最適廃棄パターンの求め方ならびにその傾向は他にも流用可能である。

畠山賢一・栗林伸一：「オールIPネットワークにおけるふくそう制御方式の提案」，成蹊大学理工学研究報告

告, Vol.44, No.2, 2007

本論文は、既存サービスや既存ネットワークで検討されているふくそう制御方式の分析を踏まえ、次世代ネットワークを含むオールIPネットワークのふくそう制御に対する基本的な考え方を提案する。また、従来ほとんど検討が行われていない複数資源を同時に割当ててを前提としたふくそう対策として、特定資源種別に着目した動的も含めた資源融通方式と特定資源種別に着目したふくそう規制方式を新たに提案し、その有効性を明らかにする。

H. Fukuda, V. Barolli, L. Barolli, and M. Takizawa :
“A Marketable Quality and Profitability Model Considering Service Providers and Consumers Relation”,
International Journal of Business Data Communications and Networking (IJBDCN), Vol.3, No.2, pp.51-71,
April-June 2007

邦文題目：サービス提供者と利用者を考慮したマーケット可能品質と収益性のモデル

In this paper, we present a model to evaluate both: marketable quality and the profitability considering service providers and consumers relation. We use the real values of some leading Japanese manufacturing corporations as virtual data of service providers to our proposed model to analyze its accuracy. By analysis we found that the theoretical and real standard values of the marketable quality indicator for the rate of operation at the break event point were both 0.6 (that is 60%). This shows that the proposed model has a good approximation. From the fair relation of network providers and consumers, we provided the network pricing guidelines for the maximum profitability while enhancing the marketable quality.

T. Enokido, Y. Tanaka, V. Barolli, and M. Takizawa :
“Distributed Multi-Source Streaming Models in Peer-to-Peer Overlay Networks”, Journal of Simulation Modeling Practice and Theory, Vol.15, No.4, pp.426-464, April 2007

邦文題目：P2Pオーバーレイ・ネットワークでの分散型多ソース・ストリーミング・モデル

Multimedia contents are distributed to peer computers (peers) and a contents peer which

holds contents can provide other peers with the contents in peer-to-peer (P2P) overlay networks. Here, contents peers are mainly realized in less-reliable and low-performance personal computers. Multimedia streaming is more significant than downloading ways in multimedia applications from security and economical reasons. We discuss distributed multi-source streaming models to support peers with reliable and scalable multimedia streaming service. Here, a collection of multiple contents peers in parallel transmit packets of a multimedia content to a leaf peer to realize the reliability and scalability. Each of the contents peers sends different packets from the other contents peers at slower rate. Even if not only some number of peers stop by fault and are degraded in performance but also some number of packets are lost and delayed in networks, a leaf peer has to receive every data of a content at the required rate. We discuss how to replicate data of a multimedia content by creating a parity packet for some number of packets and to allocate packets to each contents peer so that a leaf peer can deliver a packet without waiting for preceding packets from other contents peers in presence of the faults. Next, multiple contents peers are required to be synchronized to send packets to a leaf-peer so that the leaf-peer can receive every data of a content at the required rate. We discuss a pair of gossip-based flooding-based protocols, DAG (directed acyclic graph)-based coordination protocol (DCoP) and tree-based (TCoP) coordination protocol to synchronize multiple contents peers to send in parallel send to a leaf peer. First, some number of contents peers are selected and start transmitting packets to a leaf peer. Then, each of the selected peers selects some number of peers. Here, a peer can be selected by multiple peers in DCoP but by at most one peer in TCoP. Finally, every contents peer transmits packets to the leaf peer at the allocated rate. We evaluate the coordination protocols DCoP and TCoP in terms of how long it takes and how many messages are transmitted to synchronize multiple contents peers.

S. Itaya, T. Enokido, and M. Takizawa : “Scalable Multimedia Streaming Model in Heterogeneous Networks”, *International Journal of High Performance Computing and Networking (IJHPCN)*, Vol.5, No.1/2, pp.62-74, 2007

邦文題目: 異種ネットワークでの大規模マルチメディア・ストリーミングのためのモデル

In a Peer-to-Peer (P2P) overlay network, a large number and various types of peers are co-operating by exchanging multimedia contents. Here, multimedia streaming is a key technology to realize multimedia applications. In multimedia streaming applications, multimedia contents are required to be efficiently delivered to processes in a real-time manner. Some contents peer may not send packets at a required rate and a communication channel may not support enough Quality of Service (QoS). In this paper, we newly discuss a Heterogeneous Asynchronous Multi-Source Streaming (HAMS) model where multiple contents peers transmit packets of a multimedia content to a requesting leaf peer to realize high reliability and scalability.

Y. Tanaka, N. Hayashibara, T. Enokido, and M. Takizawa : “A Mobile Agent Model for Fault-Tolerant Manipulation on Distributed Objects”, *International Journal of Cluster Computing (IJCC)*, Vol.10, No.1, pp.81-93, March 2007

邦文題目: 分散オブジェクトを操作するための移動型エージェント・モデル

In this paper, we discuss how to realize fault-tolerant applications on distributed objects. Servers supporting objects can be fault-tolerant by taking advantage of replication and checkpointing technologies. However, there is no discussion on how application programs being performed on clients are tolerant of clients faults. For example, servers might block in the two-phase commitment protocol due to the client fault. We newly discuss how to make application programs fault-tolerant by taking advantage of mobile agent technologies where a program can move from a computer to another computer in

networks. An application program to be performed on a faulty computer can be performed on another operational computer by moving the program in the mobile agent model. In this paper, we discuss a transactional agent model where a reliable and efficient application for manipulating objects in multiple computers is realized in the mobile agent model. In the transactional agent model, only a small part of the application program named routing subagent moves around computers. A routing subagent autonomously finds a computer which to visit next. We discuss a hierarchical navigation map which computer should be visited prior to another computer in a transactional agent. A routing subagent makes a decision on which computer visit for the hierarchical navigation map. Programs manipulating objects in a computer are loaded to the computer on arrival of the routing subagent in order to reduce the communication overhead. This part of the transactional agent is a manipulating subagent. The manipulation subagent still exists on the computer even after the routing subagent leaves the computer in order to hold objects until the commitment. We assume every computer may stop by fault while networks are reliable. There are kinds of faulty computers for a transactional agent: current, destination, and sibling computers where a transactional agent now exists, will move, and has visited, respectively. The types of faults are detected by neighbouring manipulation subagents by communicating with each other. If some of the manipulation subagents are faulty, the routing subagent has to be aborted. However, the routing subagent is still moving. We discuss how to efficiently deliver the abort message to the moving routing subagent. We evaluate the transactional agent model in terms of how long it takes to abort the routing subagent if some computer is faulty.

K. Watanabe, Y. Nakajima, T. Enokido, and M. Takizawa : “Ranking Factors in Peer-to-Peer Overlay Networks”, *ACM Transaction on Autonomous and Adaptive Systems(TAAS)*, Vol.2, No.3, Article 11,

pp.11:1-11:26, Sept. 2007

邦文題目: P2P オーバレイ・ネットワークでのランキング因子

A large number of peer processes are distributed in a peer-to-peer (P2P) overlay network. It is difficult, may be impossible for a peer to perceive the membership and location of every resource object due to the scalability and openness of a P2P network. In this paper, we discuss a fully distributed P2P system where there is no centralized controller. Each peer has to obtain service information from its acquaintance peers and also sends its service information to the acquaintance peers. An acquaintance peer of a peer p is a peer about whose service the peer p knows and with which the peer p can directly communicate in an overlay network. Some acquaintance peer might hold obsolete service information and might be faulty. Each peer has to find a more trustworthy one in acquaintance peers. There are many discussions on how to detect peers which hold a target object. However, a peer cannot manipulate an object without being granted access rights (permissions). In addition to detecting what peers hold a target object, we have to find peers granted access rights to manipulate the target object. The trustworthiness of each acquaintance is defined in terms of the satisfiability and ranking factor in this paper. The satisfiability of an acquaintance peer shows how much each peer can trust the acquaintance peer through direct communication to not only detect target objects but also obtain their access rights. On the other hand, the ranking factor of an acquaintance peer indicates how much the acquaintance peer is trusted only by trustworthy acquaintance peers differently from the traditional reputation concept. We evaluate how the trustworthiness of acquaintance peer is changing through interactions among peers in detection algorithm.

V. Barolli, H. Fukuda, L. Barolli, and M. Takizawa :
“A Computing Model for Enhancing Service Quality and Increasing Profitability of Corporations : Model Evaluation Based on Two Different Sources Data”,

Service Oriented Computing and Applications (SOCA), Vol.1, No.3, pp.213-222, 2007

邦文題目: 企業のサービス品質と収益性を向上させるための計算モデル: 二つの具体的事例による評価

In this paper, we introduce and evaluate a computing model for enhancing service quality of consumers and increasing profitability of corporations. We discuss the model prediction of the turning and transition period based on data from two different sources. By applying these real data of some leading manufacturing corporations in Japan we analyze the model accuracy. By using the proposed model, the corporation can increase their profit by enhancing the marketable quality. From the analysis, we conclude that even there are some differences between two sources data, the proposed model give a good approximation and prediction of the turning and transition period of Japanese economy.

V. Barolli, H. Fukuda, L. Barolli, and M. Takizawa :
“An Enhanced Network Service Pricing Model Considering Network Externalities”, Journal of Information Systems and e-Business Management (ISeB), Vol.6, No.1, pp.5-24, 2008

邦文題目: ネットワーク・エクステナリティを考慮した拡張ネットワーク・サービス・プライシングのモデル

In this paper, we provide an evaluation model for marketable quality and profitability. We define the marketable quality as a qualitative aspect of profitability. Not always there is a clear tradeoff relation between marketable quality and profitability. Therefore, it is important to discover how to increase the profitability by enhancing marketable quality. We apply the real values of some leading manufacturing Japanese corporations to our proposed model to analyze its accuracy. From the analysis, we found that theoretical and real standard values of the marketable quality indicator were both 0.6. This shows that the proposed model has a good approximation. From the fair relation of network service providers and consumers, we present the network pricing guidelines for the maximum profitability, while enhancing the marketable quality. Also, we en-

hance our proposed network service pricing model considering network externalities.

A. Durresi, L. Barolli, A. Koyama, and M. Takizawa : “Ubiquitous QoS Communications Using Scalable Satellite Networking”, *Journal of Ubiquitous Computing and Intelligence(JUCI)*, Vol.2, No.1, pp.1-8, 2008

邦文題目: 大規模衛星ネットワークを用いたユービキタスQoS通信

Satellite networking will be an important component of future ubiquitous communications systems. Satellite networks will be especially useful to interconnect remote sensor networks. Therefore, satellite networks should provide the needed QoS, differentiation of services and at the same time keep the required scalability. We propose a new Diffserv-based scheme of bandwidth allocation during congestion, called proportional allocation of bandwidth (PAB). PAB can be used in GEO, MEO and LEO satellite networks. In PAB, during congestion all flows get a share of IP available bandwidth, which is in proportion to their subscribed information rate. We suggest a method for implementing PAB without storing per-flow state, which makes the scheme scalable and simple. We show by simulation the advantages of using PAB in IP satellite networks.

A. Aikebaier, T. Enokido, and M. Takizawa : “A Distributed Coordination Protocol in an Order-Heterogeneous Group”, *International Journal of Web and Grid Services (IJWGS)*, Vol.4, No.1, pp.5-23, 2008

邦文題目: 順序異種グループでの分散協調プロトコル

In Peer-to-Peer (P2P) overlay networks, a group of multiple peer processes are required to cooperate to make a global decision. Each process takes a value and exchanges values with the other processes until the agreement condition is satisfied. We define existentially and preferentially precedent relations which show what values a process can take after taking a value and which value a process prefers to another value, respectively. Based on the precedent relations, each process takes the most preferable value in the

values which are changeable from current value, at each round. We discuss a coordination protocol among multiple values in a type of heterogeneous system, where some pair of processes has different precedent relations on the same domain. A process learns the precedent relations of another process through exchanging values. A process takes a value that other processes can take by using the knowledge on the other processes.

K. Ozaki, T. Enokido, and M. Takizawa : “Coordination Protocols for a Reliable Sensor, Actuator, and Device Network”, *International Journal of Mobile Information Systems (IJMIS)*, Vol.4, No.2, 2008, pp.147-161

邦文題目: センサー・アクチュエータ・デバイス・ネットワークの協調プロトコル

A sensor, actuator, and device network (SADN) is composed of three types of nodes, which are sensor, actuator, and actuation device nodes. Sensor nodes and actuator nodes are interconnected in wireless networks as discussed in wireless sensor and actuator networks (WSANs). Actuator nodes and device nodes are interconnected in types of networks, i.e. wireless and wired network. Sensor nodes sense an physical event and send sensed values of the event to actuator nodes. An actuator node makes a decision on proper actions on receipt of sensed values and then issues the action requests to the device nodes. A device node really acts to the physical world. For example, moves a robot arms by performing the action on receipt of the action request. Messages may be lost and nodes may be faulty. Especially, messages are lost due to noise and collision in a wireless network. We propose a fully redundant model for an SADN where each of sensor, actuator, and device functions is replicated in multiple nodes and each of sensor-actuator and actuator-device communication is realized in many-to-many type of communication protocols. Even if some number of nodes are faulty, the other nodes can perform requested tasks. Here, each sensor node sends sensed values to multiple actuator nodes and each actuator node receives sensed values from multiple sensor nodes. While

multiple actuator nodes communicate with multiple replica nodes of a device. Even if messages are lost and some number of nodes are faulty, device nodes can surely receive action requests required for sensed values and the actions are performed. In this paper, we discuss a type of semi-passive coordination (SPC) protocol of multiple actuator nodes for multiple sensor nodes. We

discuss a type of active coordination protocol for multiple actuator nodes and multiple actuation device nodes. We evaluate the SPC protocol for the sensor-actuator coordination in terms of the number of messages exchanged among actuators.

(以上10件 滝沢 誠 前職東京電機大学理工学部情報システム工学科・教授における実績)

エレクトロメカニクス学科

Taesoo Song, Akira Ninomiya, Takeshi Ishigohka :
“Experimental Study on Induction Motor With Superconducting Secondary Conductors”, IEEE Transactions on Applied Superconductivity, Vol.17, No.2, pp.1611-1614, 2007.6

邦文題目：超電導二次巻線を有する誘導電動機に関する実験的研究

A superconducting induction motor with Bi-2223/Ag HTS secondary conductors in the rotor is studied experimentally. If the superconductor is applied to the secondary winding of an induction motor, a higher efficiency and a higher power and a higher starting torque can be expected. The authors remodeled the rotor of a commercial 200 W (4 pole) induction motor and made an experimental HTS induction motor. The cast aluminum in the rotor slots are cut-in by 5mm in depth and HTS tapes are put in the slots. Thus, the original conventional 200 W induction motor was remodeled to a HTS induction motor. The experimental motor was immersed in a liquid nitrogen bath. And, a no-load test, a locked test, a variable frequency locked test, and a load test of the HTS induction motor were carried out in liquid nitrogen bath. The experimental results are presented together with some theoretical analysis.

S. Nishimiya, T. Ishigohka, A. Ninomiya, K. Arai :
“Quench Characteristic of Superconducting Transformer by Inrush Current”, IEEE Transactions on Applied Superconductivity, Vol.17, No.2, pp.1931-1934, 2007.6

邦文題目：励磁突入電流による超電導変圧器のクエンチ

特性

An inrush current of transformer reaches about several times larger than the rated current. When such a large inrush current flows into a superconducting transformer, it will induce a quench of superconducting windings. In this paper, we fabricated a small experimental superconducting transformer, and investigated the behavior of superconducting winding against the inrush current. The experimental result shows that a superconducting winding quenches for such a large inrush current, but it returns quickly to superconducting state in few cycles spontaneously.

H. Matsuura, A. Ninomiya, T. Ishigohka : “Tolerance Current” of Bi-2223/Ag Coil”, IEEE Transactions on Applied Superconductivity, Vol.17, No.2, pp.1611-1614, 2007.6

邦文題目：Bi-2223/Ag超電導コイルの耐電流特性

Compared to low temperature superconductors, Bi-2223/Ag HTS tapes have lower “n” value. This characteristic brings rather “fuzzy” notification of the critical current. It depends on the cooling condition. This means that the critical current of Bi-2223/Ag tape can not be decided absolutely. Rather we should focus on the temperature rise characteristics of the coil against over-current exceeding the critical current. If the temperature of the coil keeps a finite value without thermal runaway, the coil can be used continuously. We call the uppermost current without thermal runaway as “tolerance current”.

Considering the situation mentioned above, the authors have studied the temperature rise char-

acteristics of HTS coil for both DC and AC currents. Two cooling conditions are adopted. One is a cooling by immersion in liquid nitrogen bath, and the other is a conduction cooling by GM refrigerator. From the experimental result, the “tolerance current” of the Bi-2223/Ag coil for various conditions are obtained.

Makoto Hamabe, Atsushi Sasaki, Tosin S.Famakinwa, Akira Ninomiya, Yasuhide Ishiguro, Satarou Yamaguchi : “Cryogenic System for DC Superconducting Power Transmission Line”, IEEE Transactions on Applied Superconductivity, Vol.17, No.2, June 2007, pp.1722-1725

超伝導直流送電の可能性を目的としたケーブルの冷却特性をいくつかの異なる輻射シールドを用いて実験的に検討を行った。ここでは内層側表面にアルミホイルを貼り付けることで、300Kと77Kの間の熱負荷を大きく低減させる効果があることがわかり、その値はこれまでターゲットとしていた1 W/mの2倍程度あることが判明した。

壱岐浩幸, 瓜生芳久 : 「離散型無効電力調整器群の効率的運用を目的とした動的最適潮流計算法」, 電気設備学会誌, 平成19年9月号, J.IEIE Jpn. Vol.27.No.9, pp.776-782

1995年以降の電気事業法改正による電力市場への規制緩和の導入に伴い新たな発電事業者の参入が進み、電力系統は複雑化、競争化の傾向にある。この規制緩和の範囲はさらに拡大していくとされており、今後の系統運用には安全性、経済性のより一層の向上が必要であると考えられている。安全性と経済性は相反する要求であると考えられるが、この要求を出来る限り満たすための手法として最適潮流計算 (OPF : Optimal Power Flow calculation) の研究が行われおり、さらに近年では時間毎の負荷の変化を考慮したOPFである動的最適潮流計算の研究も行われている。

安全性に求められている事の一つは負荷電圧を適正範囲内に維持する事であり、経済性に求められている事は発電機燃料コストの削減であると考えられる。本論文では、無効電力調整器を用いて負荷電圧を適正範囲内に維持しつつ、燃料コストを低減し、なおかつ離散値をとる無効電力調整器の切替が出来る限り少なく済む様な運用を目指す動的最適潮流計算手法の有効性を報告する。

村松大吾・加藤雄大・松本 隆 : 「モンテカルロ法を用いたオンライン署名認証」, ヒューマンインターフェース学会論文誌, Vol.9, No.2, pp.191-200, 2007.5

高精度オンライン署名認証アルゴリズムを構築するために、2つのモンテカルロ法を用いた手法を提案。真筆・偽筆の判定を行なうモデルのパラメータ推定にマルコフ連鎖モンテカルロ (Markov chain Monte Carlo (MCMC)) 法を用い、そのパラメータを逐次モンテカルロ (Sequential Monte Carlo (SMC)) 法を用いて逐次学習することで経時変化にも強いアルゴリズムを構築した。

窪田 悟 : 「有機ELディスプレイの画質評価」, 映像情報メディア学会誌, 62巻, 1号, pp.122-125, 2008.1

We compared the image quality of organic light-emitting diode (OLED) displays with that of LCDs by quantitatively measuring image quality parameters and subjectively evaluating images on the displays. Results showed that the black-level and contrast performance of OLED displays are superior to those of LCDs in a wide range of ambient light conditions. For these properties, the subjective image quality of fireworks images on OLED displays was particularly high. Image quality features of OLED display images are also discussed.

窪田 悟, 小田泰久 : 「Webページ上での不特定多数による視覚のコントラスト感度特性測定の試み」, 映像情報メディア学会誌, 61巻, 7号, pp.1021-1024, 2007.7

Webページ上で視覚のコントラスト感度特性を測定するシステムを開発し、303名のPCユーザーからWebを介して測定結果を得た。同時に被験者の属性やPC画面上で好ましい文字サイズに関するデータなどを取得し、コントラスト感度の測定結果との関係について検討した。その結果、被験者の年齢や視力矯正方法とコントラスト感度との間に関係が認められた。また、測定値は従来の実験室での測定値とほぼ一致していることを確認した。さらに、被験者が選択した好ましい文字サイズとコントラスト感度との間にもある程度の関係が認められ、個々のユーザーのコントラスト感度特性を考慮した文字表示の可能性が示唆された。

齋藤洋司・五十嵐哲治・大久保祐：「大気圧バリア放電によるトルエン分解と副生成物質生成に及ぼす酸素・水蒸気濃度および電極温度の影響」材料の科学と工学, vol. 44, No.3, pp. 102-105, 2007.6

Decomposition of toluene was performed using an atmospheric pressure plasma system. The decomposition rate of toluene and the byproducts were investigated by gas chromatography (GC) and infrared absorption measurements. The decomposition rate of toluene increases with the increase of the oxygen content, and decreases with the water vapor content at the electrode temperature below 100°C. With increasing the electrode temperature, the decomposition rate of toluene hardly depends on the water vapor content below 4 mol%. We concluded that the system should be operated at the electrode temperatures between 200-250°C with the water vapor of about 2%.

Y. Saito and T. Kosuge : “Honeycomb-textured structures on crystalline silicon surfaces for solar cells by spontaneous dry etching with chlorine trifluoride gas” Solar Energy Materials and Solar Cells, vol. 91, pp.1800-1804, 2007.7

邦文題目：ドライエッチングにより作製した太陽電池用結晶系シリコン上ハニカム状テクスチャー構造

Reflection loss of silicon solar cells can be reduced by texturization of the surfaces. In this study, single- and multi-crystalline silicon substrates were treated with chlorine trifluoride (ClF_3) to create honeycomb-textured structures. We investigated surface structures and optical properties of the textured surfaces. By the treatment with ClF_3 gas, the reflectance of the textured surface without antireflection coating was obtained to be below 20% at wavelengths between 300 and 800 nm. The solar cells using the textured substrates were fabricated and their improved performances were demonstrated.

小林伸彰, 柴田昌明：「ステレオビジョンロボットを用いた移動対象に対する追従法」, 電気学会論文誌D（産業応用部門誌）, Vol. 127 (2007), No. 6 pp.643-650, 2007.6

In this paper, we propose a visual tracking

method for a moving object without tracking delay. On visual servoing, image-based method with image Jacobian is often taken for target-centering camera motion control because it does not require target's 3D position estimation and is robust to modeling errors and noises. In an ordinary visual servoing approach, it is assumed that the target object would be fixed in the workspace. Therefore, for the purpose of tracking to a moving target, the image errors always exist between the target position and camera optical axis, that is, the visual tracking delay. In our proposed method, the target object's 3D position is estimated with the technique based on triangulation on stereo vision system. Then, the moving velocity is calculated in the camera coordinate frame. The image Jacobian concerns the camera velocity with the target velocity in the image plane. Additionally, the target velocity in 3D workspace is also converted into the velocity in the image plane. The converted velocity compensates the camera velocity to compensate the camera motion delay. This approach enables to achieve non-delayed tracking for moving target.

市川麻理子, 柴田昌明：「ハンドアイビジョンシステムのための近似型監視動作制御法」, 電気学会論文誌D（産業応用部門誌）, Vol. 127 (2007), No.6 pp.651-652, 2007.6

This paper proposes a visual servo control method for exploring motion of eye-in-hand robot to recognize a three-dimensional object. Optimal motion is based on the strategy in which the position estimation precision of the feature points gets improved when the feature points move widely, and the optimal robot motion provides the widest transitions of the feature points per unit robot motion, so that the robot should be controlled to pursue such motion. In addition, this paper describes the way to reduce a large number of calculation efforts. The validity of our approach is confirmed in the several experimental results.

伊藤正英・戸田尚宏：「IDA-PBC 法による 3 関節劣駆動マニピュレータの制御」, 計測自動制御学会論文集, Vol.43, No.9, pp.788 - 797, 2007.9

We present an application of Interconnection and Damping Assignment Passivity-Based Control (IDA-PBC) method to an underactuated manipulator with the third joint unactuated which is subject to second-order non-holonomic constraints. We give a port-Hamiltonian representation of the manipulator system by selecting an appropriate

set of generalized coordinates and applying a global input transformation. And we clarify the applicable conditions and design an inertia matrix and a potential energy function of the closed Hamiltonian system. Numerical experiments are given to show the validity of the derived controller.

共通基礎

K. Tanaka, K. Kohayakawa, T. Irie, S. Iwata, and K. Taguchi : “Novel photoinduced cyclization of pentafluorophenylhemithioindigo”, *J. Fluorine Chem.*, Vol. 128, No. 10, pp. 1094-1097, 2007. 10

邦文題目：ペンタフルオロフェニルヘミチオインジゴの新規な光誘起環化反応

Photoirradiation of pentafluorophenyl-substituted *Z*-hemithioindigo **1** causes a novel type of photoinduced cyclization, to produce the intramolecularly cyclized alcohol and its dehydrated ether. The *o*-fluorine atoms of the phenyl group of **1** are found to be crucial for this photoinduced cyclization.

M. Chiba, T. Kamijo, Y. Watanabe, M. Fujii, Y. Shibasaki, Y. Takayama, F. Yabuki, O. Yasuda, A. Amano, Y. Chikashige, T. Kon, S. Mori, S. Ninomiya, Y. Shimizu, Y. Takeoka and M. Utsumi : “Measurement of attenuation length for radio wave in natural rock salt and performance of detecting ultra high-energy neutrinos”, *J. Phys. Conf. Ser.* 81:012003, 2007

邦文題目：天然岩塩中でのラディオ波の減衰長測定と超高エネルギーニュートリノ検出

Ultra high-energy (UHE) neutrinos ($E > 10^{15}$ eV) is expected to exist due to presence of the cosmic microwave background and UHE cosmic rays implied by Greisen, Zatsepin and Kuz'min (GZK). The low rate of GZK neutrinos requires us to utilize a large mass (50 Gton) of detection medium. Collision between the UHE neutrino and the rock salt produces electro magnetic shower, which includes a huge number of unpaired electrons in rock salt. They would emit sensible radio wave by coherent Cherenkov effect. Attenuation lengths of natural rock salt at 0.3 and 1.0 GHz

were measured to know possibility of a salt neutrino detector. The result indicates a feasible plan with economical antenna spacing. Detection possibility of GZK neutrinos in natural huge rock salt formation has been simulated including attenuation length, background noise and bandwidth of antennae so that GZK neutrinos of 8-62 per year would be detected.

Masami Chiba, Yoko Arakawa, Toshio Kamijo, Shunsuke Nakamura, Yuji Shibasaki, Yasuhiro Takayama, Yusuke Watanabe, Fumiaki Yabuki, Osamu Yasuda, Akio Amano, Yuichi Chikashige, Keisuke Ibe, Tadashi Kon, Sosuke Ninomiya, Yutaka Shimizu, Yoshito Takeoka, Yasuyuki Taniuchi, Michiaki Utsumi, Masatoshi Fujii : “Reflection of microwave from energy deposit by X-ray irradiation in rock salt: Implication of an ultra high energy salt neutrino detector to act like a radio bubble chamber”, the proceedings of 15th International Conference on Supersymmetry and the Unification of Fundamental Interactions (SUSY07), Karlsruhe, Germany, 26 Jul - 1 Aug 2007.

邦文題目：天然岩塩中でのラディオ波の減衰長測定と超高エネルギーニュートリノ検出岩塩中にX線吸収として蓄積されたエネルギーによるマイクロ波反射：ラディオ泡箱のように振舞う超高エネルギーニュートリノ検出器の内容

Existence of GZK neutrinos (ultra high energy neutrinos) have been justified although the flux is very low. A new method is desired to use a huge mass of a detector medium to detect them. A fundamental study of radar method was carried out to measure microwave reflection from electromagnetic energy deposit by X-ray irradiation in a small rock salt sample. The reflection rate of

1×10^{-6} was found at the energy deposit of 1×10^{19} eV which was proportional to square of the X-ray intensity suggesting the effect to be coherent scattering. The decay time of the reflection was several seconds. This effect implies a large scale natural rock salt formation could be utilized like a bubble chamber irradiated by radio wave instead of visible light to detect GZK neutrinos.